The Effects of Dustfall from Potash Refineries on Soils

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In 1964 when it became obvious that a number of potassium mines were and would be built in Saskatchewan, the soils personnel realized that the possibility of soil contamination around these mines would have to be checked. I was chosen to do this work.

It was a double problem. First, it had to be determined if the mines would contaminate the soil. Secondly, if they caused soil pollution, how much could take place before the productivity of the soil was reduced. Permanent sample sites were chosen as the method of checking the possibility and amount of salt contamination. Some of the mines were located in areas where we had recently completed soil surveys. At the other mines I did a soil survey within a six mile radius of each mine. Within this radius of six miles, I chose to locate approximately 40 permanent sampling sites. These sites were a 25 yd^2. circle. Within this area with a hydraulic coring machine five cores were taken to 4 feet. The upper two feet were separated into 6 inch segments, the remainder in 12 inch segments. The five similar depths were then composited to one sample. These were analyzed for water-soluble Ca, Mg, Na, K and Cl. Exchangeable cations are determined on the upper 6 inch samples.

The selection of these sites was rather biased. They were selected on the basis of the prevailing winds, very few sites were placed due north or south of the mines. They were selected in relation to the soils of the area. Most of them were selected so that if they gained salts it would have to come from above. Around each mine in varying amounts there are slightly to moderately saline soils. Sites were placed on these soils.

The amount of potassium mine dust that can be added to our soil to a degree that it becomes harmful to plant growth has been checked with four growth chamber experiments. Three of these were on amounts of salt, moisture and fertilizer in relation to wheat growth. The fourth was to simulate what will happen in the field as potassium salts are added to a non-saline soil.

Two field trials, one at Laura on a non-saline silt loam soil, the other at Langenburg on a loam glacial till with a slightly saline sub-soil. These plots received rates from 1/2 to 5 ton per acre with adjacent check strips.

The first three experiments indicated (they were on different soils) that when the salt content of the soil reached a level where the conductivity of the saturated extract became 6 mmhos/cm, it was no longer suitable for wheat growth. Fertilizer or higher moisture extended this slightly.

There has been no reduction in wheat, oats, or barley yields on any of the field trial strips.

The slow addition of potassium salts to a non-saline soil will very likely never make the soil saline, but it could cause the soil to become completely unproductive. The potassium salts will remain in the upper portion of the soil and replace calcium and magnesium. These will leach to lower depth. When the amount of exchangeable K in the soil becomes greater than 30% it will become harmful to plant growth.

The two harmful levels are 6 mmhos/cm for salinity and 30 for exchangeable K percentage.

Have the K mines contaminated our soils? One must realize that there is no such thing as a non-saline soil. All soils contain water-soluble salts, if not they would not grow plants. It is only when the level of these salts become harmful that the soil is referred to as saline. These salts in the soil

fluctuate from year to year. We have sampled our sites now for 5 or 6 years and have no indication that there has been a definite or significant increase in salinity around any mine. From the work that I have done I believe that on some soils I could detect the addition of 1/2 ton K salt per acre and that on most soils a 1 ton addition would be detected. These are far below the critical levels.

Before we become too complacent I would like to show two graphs. The first is the average Cl content in the upper six inches of the soil in all the sites (6) within 1½ miles of one mine. This mine got into production before I did. It is highly unlikely that by some chance of fate that this mine was located in an area where the Cl in the surface soil decreased in all directions as one went out from the mine. I have taken the liberty of projecting the original Cl content of this area. I took the average Cl content of the upper 6 inches of soil in all the sites 3 miles and out from this mine. Cl moves downward fairly rapidly in soil, but there was a definite increase in the surface soil near this mine following the first year of production. Originally this mine did not have a dust collector but installed one at a later date. The second graph shows the average conductivity and Cl for all depths of soil from all sites. They show the same trend as the first graph.

As stated previously there has been no indication of contamination to the soil but the potential for damage is present.

Our future plans: - we will continue to sample the permanent sites every second year. Last fall on the field trial at Laura we added an additional 5 ton/acre of salt dust to the original 3 ton/acre strip, and 10 ton/acre to the original 5 ton/acre strip. The 8 ton per acre strip should not reduce

yields, I hope that the 15 ton/acre does. The plot is in summerfallow in 1972 which will give the salts time to leach into the soil. In 1973 we will sample the crop, 1974 in summerfallow, 1975 will sample crop again. The soils will be sampled each year. If the 1975 samples are low in conductivity and high in exchangeable K I will add 5 ton/acre dolomite to the soil. There are indications from growth chamber work that this could reclaim the soil. In 1979 we may have the final results (15 years).

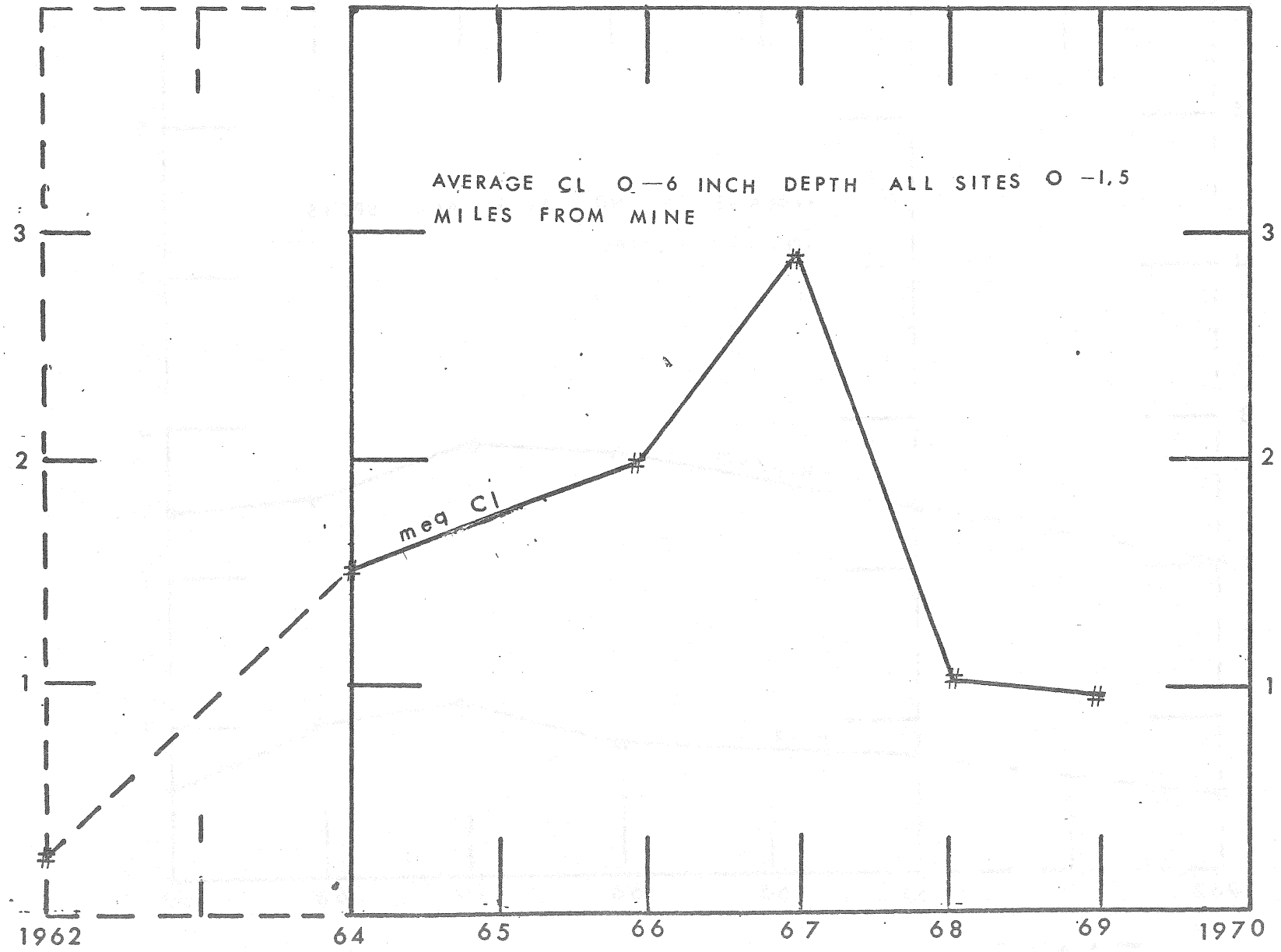
AVERAGE CL 0—6 INCH DEPTH ALL SITES 0 —1.5 MILES FROM MINE
meq Cl
3
2
1
1962
64
65
66
67
68
69
1970

Fig. 1

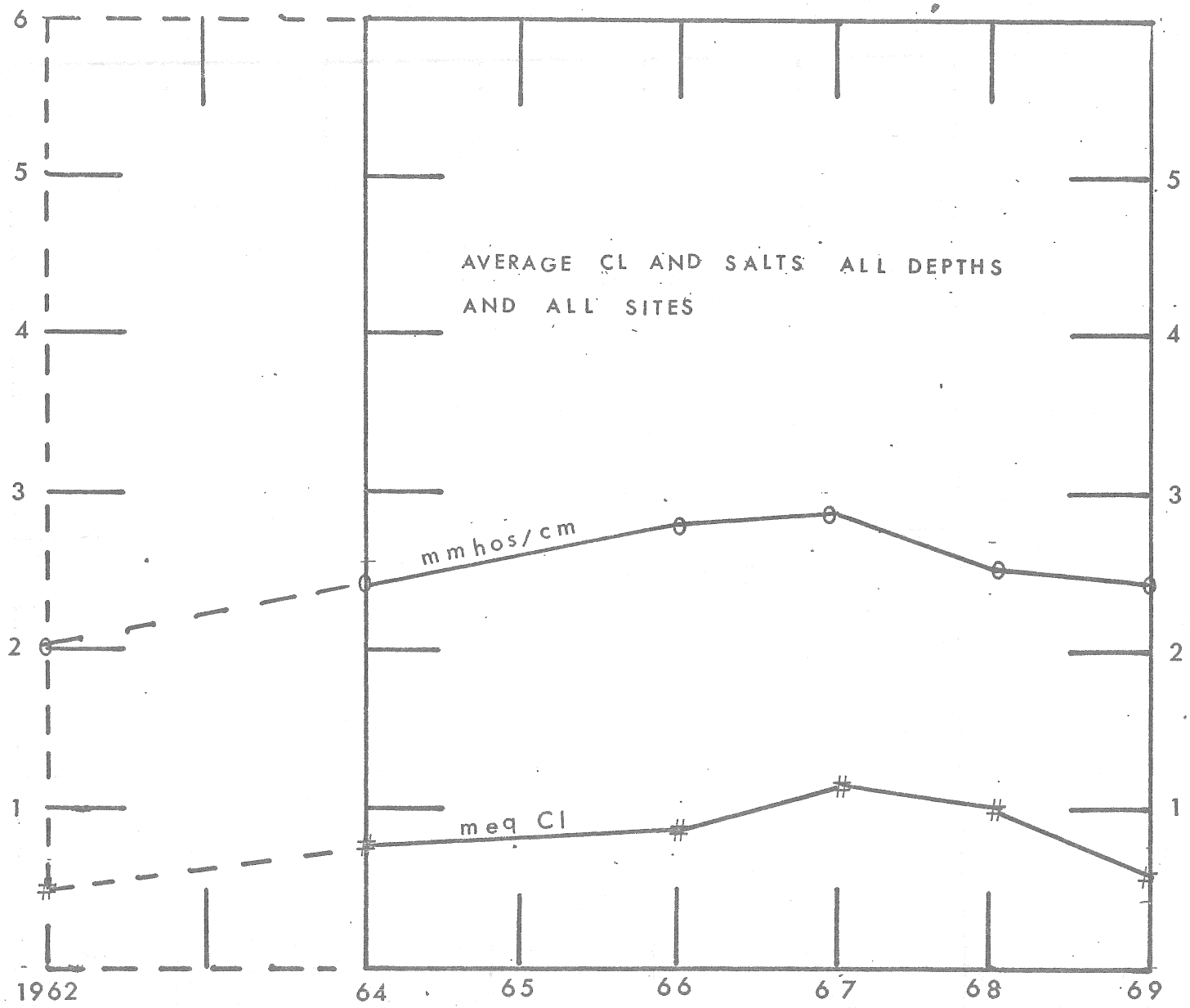
AVERAGE CL AND SALTS ALL DEPTHS
AND ALL SITES
mmhos/cm
meq Cl
6
5
4
3
2
1
1962
64
65
66
67
68
69

FIG. 2